

*BEHAVIORAL TREATMENT OF CAFFEINISM:  
REDUCING EXCESSIVE COFFEE DRINKING*

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Excessive coffee drinking can have deleterious effects because of the large amounts of caffeine that are ingested. Caffeine is thought to be addicting, and prolonged and excessive use can lead to caffeinism, a condition that has serious behavioral and physiological side effects. The present study developed and evaluated a treatment program to reduce excessive daily coffee drinking to moderate and presumably safer levels. Three habitual coffee drinkers received individualized changing criterion programs that systematically and gradually reduced their daily caffeine intake. The coffee drinkers were required to self-monitor and plot their daily intake of caffeine. They received monetary prizes for not exceeding the treatment phase criteria and forfeited a portion of their pre-treatment deposit when they did. Their coffee drinking decreased from almost nine cups per day (over 1100 mg of caffeine) during baseline to less than three cups per day (less than 343 mg) at the end of treatment or a reduction of 69%. The treatment effect was maintained during a 10-month follow-up, averaging a 67% reduction from baseline. The program appears to be a reasonable method of reducing and then maintaining daily caffeine intake at less harmful levels.

DESCRIPTORS: self-recording, coffee drinking, caffeinism, changing criterion design, adults

Caffeinism describes a set of behavioral and physiological symptoms caused by the excessive consumption of caffeine-containing substances (Greden, 1974; McManamy and Schube, 1936; Powers, 1925; Reimann, 1967). The symptoms include nervous irritability, tremulousness, occasional muscle twitchings, insomnia, sensory disturbances, tachypnea (an abnormally rapid rate of breathing), palpitations, flushing, arrhythmias (an alteration or abnormality of normal cardiac rhythm), diuresis, and gastrointestinal disturbances (Greden, 1974; Powers, 1925; Reimann, 1967; Truitt, 1971). Individuals suffering from caffeinism are sometimes misdiagnosed as anxiety neurotics because of the similarity of the symptoms (Greden, 1974). The deleterious effects of caffeine on hu-

mans also may include increasing the possibility of coronary heart disease in susceptible persons, promoting the progress of atherosclerosis and affecting chromosomal structure or action (Punke, 1974).

Caffeine is America's most widely used central nervous system stimulant; it is contained in various popular beverages such as coffee, tea, and colas; prescription medications such as APCs; over-the-counter analgesics such as Anacin; over-the-counter stimulants such as No-Doz; and cold preparations such as Dristan (Greden, 1974). Of all the sources of caffeine, coffee contains the greatest amount of caffeine in a single serving and is ingested more often by more adults than any other caffeine source or beverage. In 1972, Americans spent over 1.4 billion dollars for over 150 billion cups of coffee or a per capita consumption of 36 gallons, and more persons over age 10 drank coffee daily (64%) than milk (51%), soft drinks (47%), or tea (27%) (Ray, 1974).

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Thus, it is not surprising that the primary cause of caffeinism is excessive coffee drinking. A daily intake of over 1000 mg of caffeine (approximately eight cups of brewed coffee at 125 mg per cup) is considered to be potentially quite harmful (Greden, 1974). Currently, caffeinism is a little recognized yet widespread problem because of the number of individuals whose daily ingestion of brewed coffee exceeds eight cups.

A major problem in treating caffeinism by reducing an individual's daily coffee intake is that caffeine may have addicting properties (Ray, 1974), as shown by documented withdrawal and tolerance effects. Individuals who ingested more than six cups of coffee daily have described physiological withdrawal effects, such as headache, irritability, and nervousness, when their daily intake was reduced substantially (Goldstein and Kaizer, 1969), and these symptoms disappear when they were given 300 mg dosages of caffeine (Goldstein, Kaizer, and Whitby, 1969). Caffeine withdrawal effects, especially headaches, have also been produced by giving large doses of caffeine (in capsule form) over time and then substituting placebo capsules (Dreisbach and Pfeiffer, 1943). Excessive coffee drinkers also appear to acquire a tolerance to two actions of caffeine, diuresis (Eddy and Downs, 1928) and salivation (Winsor and Strongin, 1933), since regular coffee drinkers require large caffeine dosages to produce these physiological actions, whereas occasional coffee drinkers or abstainers require small dosages. Furthermore, coffee drinkers can be given caffeine at bedtime without experiencing ill effects, while nondrinkers on the same dosage report difficulty falling asleep (Colton, Gosselin, and Smith, 1968). Finally, coffee drinkers tend to increase their daily consumption over a period of years in order to produce the same desirable physiological effects of caffeine that had been experienced from smaller amounts in earlier years (Goldstein and Kaizer, 1969).

To date, there are no behavioral studies of caffeinism. However, recent smoking research (Foxx and Brown, 1979) may provide a partial

model to apply to caffeinism, because coffee drinking and cigarette smoking are somewhat similar. Both involve the ingestion of substances, caffeine and nicotine, that are considered to produce physiological dependence, and both have a multitude of behavioral aspects associated with them that could be described as psychological dependence. The Foxx and Brown (1979) program considered both the physiological and behavioral factors involved in the smoking habit by systematically weaning smokers from nicotine (they changed brands until they were smoking the lowest nicotine cigarette commercially available, at which time they were to quit smoking), while also providing them with positive feedback regarding their success (they plotted their daily intake of nicotine throughout treatment).

The present study developed a program, modeled in part on the Foxx and Brown smoking study, that would decrease the caffeine ingested by excessive coffee drinkers to a moderate level. Moderation was the goal rather than abstinence since, unlike nicotine which is harmful in any amount, the ingestion of reasonable amounts of caffeine (five cups of brewed coffee or less) has not been shown to be harmful.

## METHOD

### *Subjects*

Individuals interested in reducing their coffee intake were asked to complete a questionnaire that asked them the following: (1) demographic and biographical information; (2) the number of cups of coffee consumed daily; (3) the number of years they had drunk coffee daily; (4) the brands and types of coffee consumed, *i.e.*, Maxim instant; (5) their reasons for wanting to reduce their coffee consumption; (6) their longest period of abstinence since they had become regular coffee drinkers; (7) to list and rank order all other beverages that they consumed regularly; and (8) to list any prescription medications and over-the-counter stimulants

taken daily and their dosages.<sup>1</sup> Three of seven respondents were chosen. The three met the following criteria: (1) They consumed eight or more cups of brewed coffee per day (over 1000 mg caffeine); (2) They reported being bothered by "coffee nerves" and other physiological and behavioral symptoms associated with excessive caffeine intake; and (3) They expressed a desire to reduce their daily coffee consumption. Subject 1 was a female school teacher married to Subject 2, a graduate student who also was employed full time. Subject 3 was a psychologist. They had been regular coffee drinkers an average of 12 years.

### *Experimental Design*

A changing criterion design (Hartmann and Hall, 1976) was employed to reduce systematically and gradually the subjects' average baseline caffeine intake over a 4-week treatment period.

### *Procedure*

**Baseline.** During baseline, the subjects recorded the number and types of all caffeine-containing beverages they drank daily. The baseline was 16 days for Subjects 1 and 2, and 14 days for Subject 3. At the end of baseline, they met individually with the second author who calculated their baseline daily intake of caffeine in milligrams. The treatment goal for all subjects was to decrease their daily caffeine intake from their baseline level to 600 mg (fewer than five cups of brewed coffee). This 600 mg figure was subtracted from each baseline mean and then divided by four (the number of treatment phases) to yield the number of mg of caffeine reduction for each phase. For example, during baseline, Subject 2 consumed an average of 1148 mg of caffeine daily. His caffeine reduction for each phase was 137 mg (1148 mg minus 600 mg divided by four).

**Treatment.** At the post-baseline meeting, the subjects signed a contract that explained the study's procedure and rules (see Footnote 1). They were required to deposit \$20, half of which was returned in four equal steps during the treatment, and the other half at the 3-month follow-up. When the subjects did not exceed the criterion level on any day during a treatment phase, they received one-quarter of their \$10 deposit (\$2.50), a \$1 bonus, and remained eligible to receive a \$10 bonus at the end of treatment. If the subjects exceeded the treatment phase criterion on any day, however, they would forfeit the \$2.50 portion of their deposit (to be donated to American Heart Fund), the \$1 bonus for that phase, and the \$10 end of treatment bonus. When a subject exceeded the criterion, the treatment phase was recycled from that day and kept in force until the required number of consecutive days at criterion for that phase were met. The subject remained eligible to receive the remaining portion of the deposit and the \$1 bonus for not exceeding criterion during each of the remaining phases. However, if a subject exceeded the criterion more than once during any phase, the remaining deposit would be donated to charity.

At the beginning of treatment, the subjects were given a list of all caffeine-containing beverages and their caffeine content. Caffeine-containing medications were not listed, because none of the subjects had indicated in their questionnaires that they took any. This beverage list was modified from one compiled by Greden (1974). Whereas Greden listed the range of caffeine (mg) contained in a cup of a particular beverage, *e.g.*, brewed coffee contains 100 to 150 mg of caffeine, in the present study the mean of each range was used, *e.g.*, brewed coffee was listed as containing 125 mg of caffeine per cup. Subjects were encouraged to switch from brewed coffee (125 mg caffeine) to instant coffee (93 mg caffeine) or to a beverage containing less caffeine, *e.g.*, tea (68 mg), cola (50 mg), or, better yet, to decaffeinated coffee (only 3 mg caffeine). The meeting ended with the second

<sup>1</sup>A copy of the Coffee Drinker's Questionnaire, a copy of the treatment contract, and copies of the various recording sheets can be obtained by writing R. M. Foxx.

author describing the hazardous physical and behavioral effects of excessive caffeine intake.

*Recording.* Each day during treatment, the subjects recorded the number of cups of coffee and other caffeine-containing beverages they drank. Their recording sheets contained a list of the caffeine value (mg) for each beverage (see Footnote 1). After consuming a beverage, the subject recorded its caffeine content, the activity associated with drinking the beverage, and calculated the total intake of caffeine to that moment. (The requirement of keeping a daily running account of total caffeine intake had been specified in the contract.) At the end of each day, they plotted their total caffeine intake, caffeine intake of coffee, number of cups of all caffeine-containing beverages, and the number of cups of coffee on graphs that had been provided at the beginning of treatment. On the total caffeine intake graph, a criterion line was drawn across each treatment phase that indicated the maximum mg of caffeine that could be consumed per day. This criterion level of mg of caffeine was written also on the daily recording sheets. At the end of each treatment phase, the recording sheets were collected and examined for correctness. At this time, the subjects were instructed about the next phase and were given the money that they had earned.

Once treatment ended, the subjects ceased self-monitoring and the follow-up began. During follow-up, the subjects were contacted by telephone or in person every 2 weeks and told to record the number and types of all caffeine-containing beverages they drank for the next 2 days. They were contacted the day after the follow-up and their reports were recorded. In addition, they mailed their records to the experimenters or presented them in person.

### *Reliability*

*Treatment reliability.* The reliability problems associated with the recording of coffee drinking behavior were characteristic of those found in many other self-control studies, since the subjects self-recorded their behavior. As a

result, the reports of other individuals, "significant others," are necessary to corroborate the subjects' reports (Lichtenstein and Danaher, 1976). In the present study, each subject submitted the names and addresses of two individuals (one of whom could not be a relative) who were familiar with the subject's daily coffee drinking. Letters were mailed to the significant others, requesting that they monitor the subject's coffee drinking, together with a statement that was to be signed and returned, if they agreed to do so. Enclosed in the letter was the subject's signed release form indicating that he or she agreed to be monitored. Furthermore, all subjects made a public announcement at work that they intended to reduce their coffee drinking.

The significant others were telephoned at the end of treatment and asked, "Have you seen any differences in the subject's coffee drinking?" This end of treatment check was conducted to ensure that the subjects had noticeably reduced their coffee drinking during treatment. Because it was impossible to determine exactly whether the subjects met criteria every day, the significant others' reports were used to provide a gross reliability measure of the subjects' records. All significant others stated that they had observed either a dramatic reduction in the number of cups of regular coffee consumed across treatment phases and/or a noticeable increase in the number of cups of decaffeinated coffee consumed.

An additional reliability check was to determine if the subjects were falsifying their records. At each subject meeting, all records were scrutinized to determine if they all concurred. No errors were ever discovered, which suggested that the subjects had honestly reported their caffeine intake.

*Follow-up reliability.* In self-control studies, the most meaningful data are the posttreatment (follow-up) results because of the common relapse problem. Thus, the ultimate determinant of the caffeine reduction program's success would be whether it resulted in a stable and last-

ing modification of coffee drinking after treatment. Accordingly, special attention was paid to the veracity of the subjects' follow-up reports by contacting the significant others at each follow-up check.

One, and often two, of the subjects' significant others was telephoned immediately following each 2-week follow-up check and asked the following questions: (1) The brand(s) of coffee the subject drank most often; and (2) Whether the subject was consuming approximately more, less, or the same number of cups of coffee daily during that follow-up period as he/she had been consuming at the end of treatment and during any previous follow-up periods. In all cases, the significant others' reports agreed with the subjects' reports regarding brands of coffee and were within one cup regarding the number of cups consumed. Inasmuch as Subjects 1 and 2 were married and served as each other's significant other, their second significant others were always contacted to corroborate both their self-reports and their reports on each other.

## RESULTS

Figure 1 shows that Subject 1 never exceeded criterion and that her mean daily intake of caffeine decreased from her baseline of 1008 mg to 357 mg (a decrease of 651 mg) during the fourth and final treatment phase. Her mean daily intake of caffeine during the 10-month follow-up was 298.4 mg.

Figure 2 shows that during treatment Subject 2's daily intake of caffeine decreased from his baseline mean of 1147 mg to a mean of 357 mg (a decrease of 790 mg or over six cups of brewed coffee) and that he never exceeded criterion. His mean daily intake of caffeine during the 10-month follow-up was 250 mg. Subject 2 reported that his low, stable posttreatment consumption of caffeine through the 3-month follow-up was because he had stopped brewing coffee at work which prior to treatment had been his major source of caffeine. Between the 3- and 10-month follow-up, Subject 2 reported

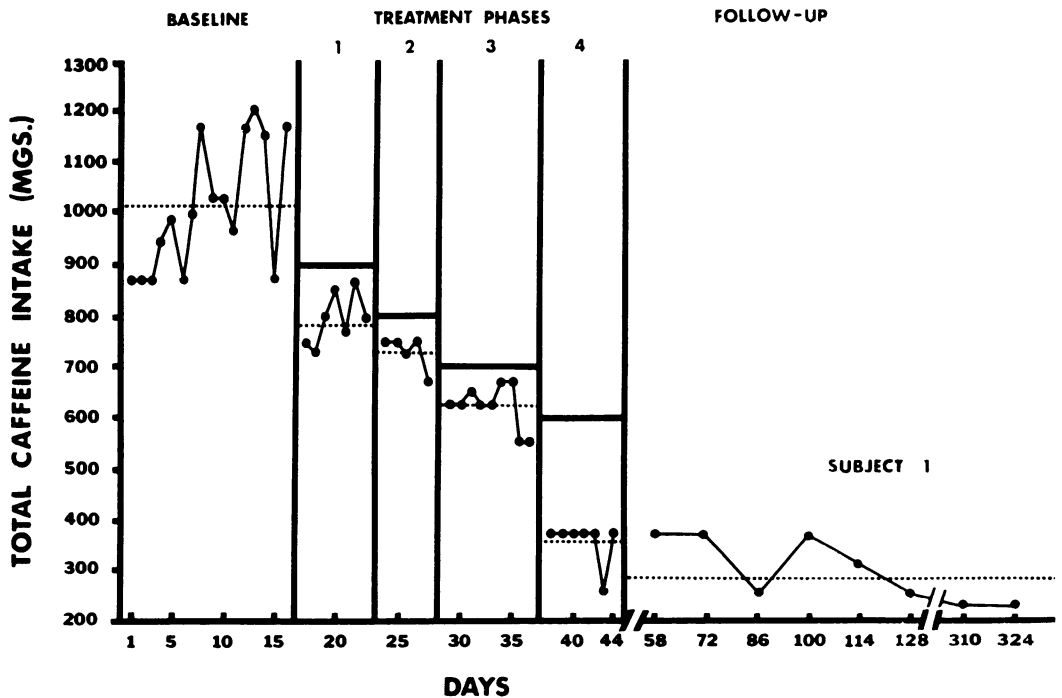


Fig. 1. Subject's daily caffeine intake (mg) during baseline, treatment, and follow-up. The criterion level for each treatment phase was 102 mg of caffeine less than the previous treatment phase. Solid horizontal lines indicate the criterion level for each phase. Broken horizontal lines indicate the mean for each condition.

that he had given up coffee and had substituted herbal teas.

Figure 3 shows that Subject 3's mean daily intake of caffeine decreased during treatment from his baseline of 1175 mg to 314 mg (a decrease of 861 mg or almost seven cups of brewed coffee). His mean daily intake of caffeine during the 10-month follow-up was 537.3 mg. He exceeded criterion twice, on days 27 and 42. Although Subject 3's caffeine intake during follow-up was quite high in comparison to the other subjects' follow-ups, he did average below the 600 mg treatment goal of less than 5 cups of brewed coffee per day.

Table 1 lists the mean number of cups of caffeine-containing beverages consumed per day during each treatment phase and follow-up. The table reveals the strategy that the subjects employed in order to avoid exceeding the criterion levels, since it shows the amount and types of reductions that were made. Subjects 1 and 2 simply reduced the number of cups of brewed

coffee they drank. They did not substitute beverages containing less caffeine except during the first treatment phase. Subject 3, however, achieved and maintained his reductions by decreasing his intake of brewed coffee, switching to instant coffee and substantially increasing his consumption of decaffeinated coffee.

*Amount of Money Earned*

Subjects 1 and 2 earned \$14, or \$4 for meeting each treatment phase criterion (\$1 per phase) and the \$10 bonus for never exceeding criterion. They were refunded their entire \$20 deposit (\$2.50 per phase for not exceeding criterion and \$10 for participating in the follow-up). Subject 3 exceeded criterion once in two different treatment phases. As a result, he earned only \$2 and forfeited the \$10 bonus. He also lost \$5 of his deposit for exceeding two treatment phase criteria. He was refunded \$5 of his deposit at the end of treatment and the remaining \$10 after follow-up.

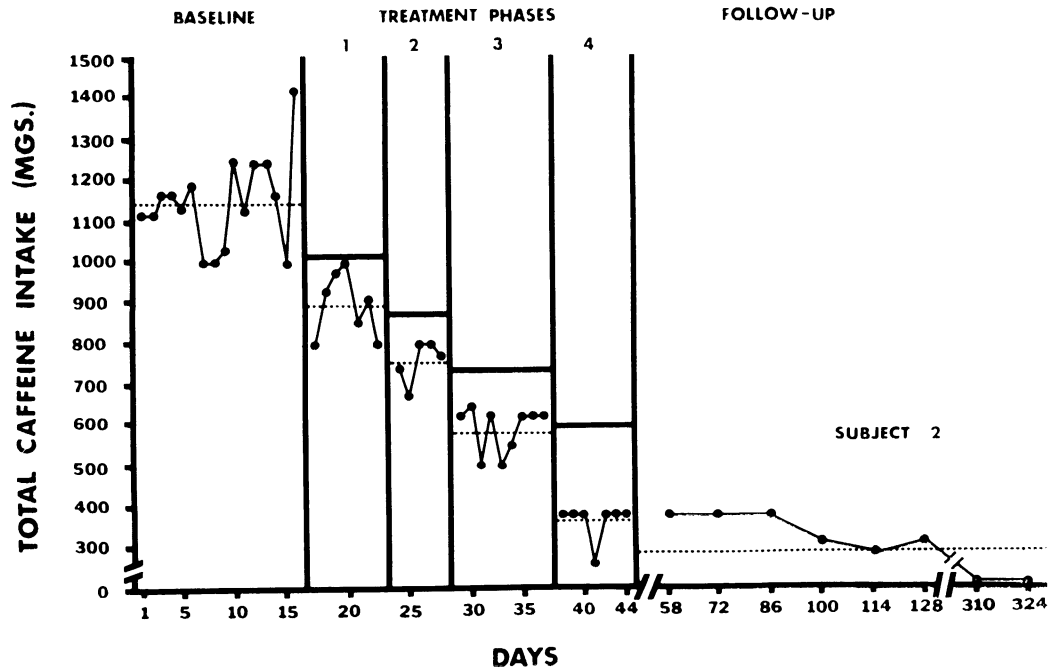


Fig. 2. Subject 2's daily caffeine intake (mg) during baseline, treatment, and follow-up. The criterion level for each treatment phase was 137 mg of caffeine less than the previous treatment phase. Solid horizontal lines indicate the criterion level for each phase. Broken horizontal lines indicate the mean for each condition.

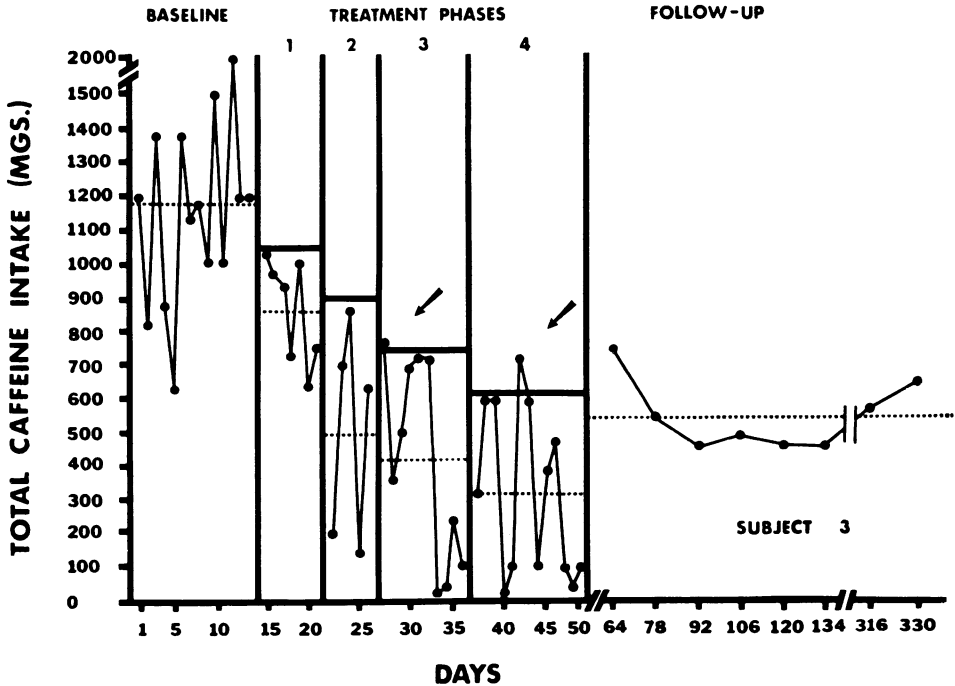


Fig. 3. Subject 3's daily caffeine intake (mg) during baseline, treatment, and follow-up. The criterion level for each treatment phase was 144 mg of caffeine less than the previous treatment phase. Solid horizontal lines indicate the criterion level for each phase. Broken horizontal lines indicate the mean for each condition. Arrows indicate days on which the treatment phase criterion was exceeded.

### Anecdotal Results

All subjects reported positive physiological and behavioral side effects at the end of treatment. Subject 1 said that she felt "healthier." Subject 2 reported that he noticed he was less tense and "hyper" at work and in his relations with others, and that he felt better physically. Subject 3 reported that he felt less irritable.

### DISCUSSION

The results showed that the program was effective in reducing excessive coffee drinking to moderate and presumably safer levels. The subjects' coffee drinking decreased from almost nine cups per day (over 1100 mg caffeine) during baseline to less than three cups per day (less than 343 mg) at the end of treatment. By the final treatment phase, Subject 1 had decreased her mean daily intake of caffeine by 64%, Subject 2 by 68.8%, and Subject 3 by 73.2%. This

effect was maintained during a 10-month follow-up; the subjects averaged a 67% reduction from baseline.

Several factors may have contributed to the success of the program: the changing criterion treatment, the individualized programs for each subject, the self-monitoring procedures, positive feedback, the deposit and contract, and the positive and negative short- and long-term monetary consequences. However, at this time, we do not know which factors, either singularly or in combination, produced the treatment effect because no component analysis was conducted. Although doubtful, it is possible that none of the program components were necessary and that other factors were responsible for the treatment effect. Other factors that could have influenced the subjects include: (1) the information they received on the deleterious effects of caffeine and on the relative amounts of caffeine in various beverages; (2) the minimal encouragement they received from the experimenters;

Table 1

Mean number of cups of caffeine-containing beverages consumed per day by each subject per condition

Condition	Subjects	Length of Phase (Days)	Caffeine-Containing Beverage				
			Brewed Coffee (125 mg)	Instant Coffee (93 mg)	Decaffeinated Coffee (3 mg)	Colas (50 mg)	Tea (68 mg)
Baseline	S1	16	7.43	0	0	1.06	.43
	S2	16	8.5	0	0	.68	.68
	S3	14	9.0	.5	0	.07	0
Treatment							
Phase 1	S1	7	5.85	0	0	1.28	0
	S2	7	6.57	0	0	1.57	0
	S3	7	6.1	1.0	.57	0	0
Treatment							
Phase 2	S1	5	5.6	0	0	.6	0
	S2	5	5.6	0	0	1.2	0
	S3	5	3.4	.8	0 <sup>a</sup>	0	0
Treatment							
Phase 3	S1	9	4.7	0	0	.77	0
	S2	9	4.5	0	0	.44	0
	S3	10	2.4	1.0	4.7	.20	0
Treatment							
Phase 4	S1	7	2.85	0	0	0	0
	S2	7	2.85	0	0	0	0
	S3	13	1.84	.69	4.69	0	0
Follow-up							
Month 1	S1	4	3.0	0	0	0	0
	S2	4	3.0	0	0	0	0
	S3	4	3.5	1.5	4.75	1.0	0
Follow-up							
Month 2	S1	4	2.5	0	0	0	0
	S2	4	2.75	0	0	0	0
	S3	4	3.6	0	2.75	0	0
Follow-up							
Month 3	S1	4	2.25	0	0	0	0
	S2	4	2.25	0	0	0	0
	S3	4	3.0	.5	3.5	0	.25
Follow-up							
Month 10	S1	4	2.0	0	0	0	0
	S2	4	0	0	0	0	0
	S3	4	4.5	.25	5.0	0	0

<sup>a</sup>Subject 3 forgot to record decaffeinated coffee during this phase.

(3) their motivation to reduce their coffee consumption as evidenced by volunteering for the project; and (4) the social pressure associated with having made a public announcement that they were reducing their coffee consumption. In summary, the present study failed to control for self-induced change. This variable could have been controlled for by including a pretreatment

condition in which the subjects were merely asked to reduce their caffeine intake for a specified period of time.

This study depended on the reports of significant others to corroborate the subjects' self-reports. The follow-up reports seemed accurate because: (1) each report was verified by one and in many cases two significant others; (2) the re-



turn of the remaining half of the deposit was dependent on reporting the number and types of beverages consumed rather than caffeine consumption; and (3) the effects of feedback were minimized somewhat because the subjects were not required to total or plot their daily caffeine intake. Several factors suggested that the subjects honestly reported their treatment data: (1) all significant others reported that the subjects *had* noticeably reduced their coffee consumption; (2) careful scrutinization of the subjects' graphs and records revealed no errors or falsifications; (3) the married couple subjects' outside significant others always verified both the couples' self-reports and their reports on each other; and (4) Subject 3's self-reported infractions added credibility to the assumption that at least one subject was honestly and reliably reporting his treatment results.

There are a couple of ways that additional partial reliability checks of the subjects' treatment reports could be made. The significant others could be contacted intermittently and asked to record on a given day the exact number and types of beverages consumed by the subject in their presence. However, unless the subject and significant other spent all their waking hours together, only a portion of the day's record could be compared. Another way would be to distribute single serving packages of instant coffee, labeled with a D (decaffeinated) or C (caffeinated) and to require the subjects to return their dated used packages after each treatment phase.

The present study should be viewed as a first effort in the development of an effective behavioral program for treating caffeinism. We hope that it calls attention to the serious and widely experienced problems caused by the excessive consumption of coffee. It appears that many individuals unknowingly suffer from caffeinism and that, in general, professionals in health-related fields are unaware of the existence of a "caffeine syndrome." As mentioned earlier, individuals suffering from caffeinism are sometimes misdiagnosed as anxiety neurotics because

of the similarity of the symptoms (Greden, 1974). Accordingly, useful diagnostic information could be obtained if therapists would routinely question their neurotic clients concerning the extent of their coffee drinking and caffeine consumption.

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